

Quick Response Report #99

GEOGRAPHIC INFORMATION SYSTEMS (GIS) IN SMALL COMMUNITIES: APPLICATION OF GIS IN EMERGENCY MANAGEMENT

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GEOGRAPHIC INFORMATION SYSTEMS (GIS) IN SMALL COMMUNITIES: APPLICATION OF GIS IN EMERGENCY MANAGEMENT

The snow began to fall in the early evening on Saturday January 6, 1996; by noon Sunday, over eighteen inches had accumulated throughout the Shenandoah Valley. On Monday the snow finally stopped leaving Washington, D.C. with over 28 inches and 36 inches in the northern Virginia's Shenandoah Valley. Federal, state, and local government agencies were closed for at least three days and most school systems in the region were closed for the week. Television and radio broadcasters along with emergency service agencies urged residents to stay home and enjoy the unplanned break. For most residents, the extensive snow presented difficulties in cleaning their autos, clearing a path to the street, and ensuring that their refrigerators were stocked. Time was needed to allow road crews to clear the streets and roads. For many communities, a state of emergency was declared limiting access to highways to road cleanup crews and emergency service personnel.

The dilemma for many local governments was in providing adequate support for snow clearing crews who were working overtime to make major and minor roads safe for travel. A major concern for local officials and residents was the possibility of power outages caused by storm. Fortunately, the storm covered the area with a light snow that resulted in no significant buildup of ice on power lines. Residents avoided a situation in which they lost power and heat with no possibility for access to a public shelter.

By early February, little melting had occurred until heavy rainfall passed through the area. The heavy rains along with the melting snow caused significant flooding in northern Virginia especially in the Shenandoah Valley. Federal disaster areas were declared in Virginia as flooding damaged homes and businesses. Although many local governments had developed good emergency response plans and geographic information decision support systems, the utility of their systems proved to be disappointing. The following summary is focused on a small rural county in northern Virginia and its attempts to use its geographic information system in emergency response, recovery, mitigation and planning activities associated with the Blizzard of '96 and the resulting flooding.

Description of Clarke County

Clarke County lies in the northern tip of the Shenandoah Valley between the Blue Ridge and Allegheny mountains, 50 miles west of Washington, D.C. The county has a total population of 12,101 as reported in the U.S. Department of Commerce 1990 census. Of these residents 3,097 are in the urban areas (25.6%) and 9,004 (74.4%) classified as rural population. Three major state routes (7, 50, and 340) cut through the small towns of Berryville with 3,097 residents and Boyce which has 512 residents. According to the 1990 census, 115 households had no telephone service. Of the 4,236 households in the county, 327 had no vehicles. The median household income for the 4,185 housing units totaled \$34,636; 8.7% of the population were below the poverty level. The county has a total school enrollment of 2,433 with 181 in preprimary, 1,859 in elementary or high school and 393 in college. Residents attending private school included 10.6% of the school enrollment.

The 1990 census data for Clarke County included a summary of non-institutionalized persons. [Table 1](#) reflects the disability status of persons in the county. For all age groups, 584 residents have a mobility or self-care limitation. In a small rural community such as Clarke County, providing emergency services to these residents poses a significant challenge. Accurate identification of the residents with mobility or self-care limitations would be most useful in emergency planning and response efforts.

Clarke County has a total of 4,531 housing units with 834 homes built since 1980. The area has experienced slow growth even though it lies within 60 miles of Washington, D.C. Twenty-six residents use utility gas; 202, bottled gas; 1,738, electricity; 1,507, fuel oil or kerosene; and 733, wood. A loss of electric utilities would affect the 55% of local residents who are dependent on electricity.

Table 1 - Disability of Civilian Non-institutionalized Persons

Persons 16 - 64 Years	7,785
With a mobility or self-care limitation	316
With a mobility limitation	144
With a self-care limitation	213
With a work disability	623
With a work disability but in labor force	294
Prevented from working	268
Persons 65 years and over	1,560
With a mobility or self-care limitation	268
With a mobility limitation	213
With a self-care limitation	147

Residents 16 years and over who are employed totaled 6,190. Of these residents, 8.2% were in agriculture, 14% in

construction, 15% in manufacturing, 11% in retail trade, 27% in services. Approximately 13% of the workers were employed by the government and 600 residents were self-employed. For the workers 16 and over, 420 worked at home and 2,600 (42%) traveled more than 30 minutes to work. For even a rural community, commuting to work is a significant factor. [Appendix A](#) provides detailed summary 1990 census information for Clarke County, and the towns of Berryville and Boyce.

The county uses a manager / administrator form of government with planning, economic development, social services, and recreation agencies reporting to the county administrator.

The County Geographic Information System

In an attempt to ensure that information would be available to county officials to make sound decisions on land use planning and zoning, the county developed a mapping unit with a geographic information system. The mapping unit is staffed by two employees who use a Sun Micro Station running ArcView (Ver.7.0). At the time of the storm and the flooding, the GIS included the following coverage's:

- Highways, streets and roads drawn from the U.S.G.S. 1:24,000 quad sheets;
- Flood zones;
- Parcel layouts with ownership information;
- Rivers, water features, pipelines, power lines, topographical contours, and benchmarks from the U.S.G.S. quad sheets;
- 5-digit ZIP code boundaries from the Postal Service;
- Agriculture districts and easements;
- Historic districts;
- County zoning areas;
- Soils by type;
- Agricultural stabilization Districts;
- Sinkholes;
- County boundaries.

Map files missing from the Clarke County GIS system were detailed information on street names, address ranges, or data reflecting business or resident locations. Information relating to residents drawn from the U.S. Department of Commerce, Bureau of the census Tiger files was not available on the system. Boundary data files for the county census tracts, block groups, or blocks and the associated 1990 census data were not in the system.

Local officials lacked adequate information on the characteristics of the county's population in areas most affected by the 36 inch snow or the flooding along the Shenandoah River and the Opecon Creek. In addition, data were not available on residents located along the major water features or the level of flooding in the county. For emergency service personnel, response to calls to the 911 Center were complicated by a lack of information on high water along roads, bridges, or areas inaccessible because of the snow. In addition, local officials had no local information to predict the extent of flooding or information on which to base warnings to residents on high water in their area. Although the GIS had U.S.G.S. contour lines and water features drawn from the 1:24,000 quad sheets, information was not included on resident locations, phone numbers of residents or businesses that could be affected by the rising water.

The county 911 Emergency Notification System included information provided by the local phone company on the location of each resident in the county. Directions to each resident had been provided either by the phone company (directions for service installation) or by a Clarke County 911 employee who confirmed directions to a resident's home. The 911 Center maintained the directions to the resident in a computerized database. Although emergency service personnel could find a residence in the county, an actual address for the resident was not available. The lack of accurate addressing for residents outside the small towns in the county made resident geocoding of addresses very limited.

The Shenandoah River flows through Clarke County, and warm weather, which melted snow along with heavy rains in

February caused the Shenadoah to flood several local roads.

Enhancing the County Geographic Information System

U.S. Department of Commerce Tiger files (1994) were provided to Clarke County by Louisiana State University's Public Administration Institute. Data in these files were imported into the ArcInfo GIS. Coverages included roads and streets, water features, railroads, census tracts, census block groups, and census blocks. The value of these data to Clarke County was to add street, road, and water feature names to line segments. Within the towns of Berryville and Boyce, the streets included address ranges. Rural roads were identified by a numbering system for the county.

Resident and business phone listings were obtained for the county from the local phone company and "select phone" listings. These listings included resident addresses with ZIP+4 files when available. Accurate geocoding was accomplished for residents in the towns. Determining the location of the remaining residents would need to be accomplished using another method.

The county manager and the GIS staff stressed the value of accurate locations for residents and businesses in the county. Emergency 911 operations could be enhanced by knowing the actual location of distressed callers. Routing of emergency vehicles could be improved by knowing exact destinations and potential problem areas such as bridges or roads. Warning systems could be adapted to notify residents affected by rising water, chemical spills on state highways or rail lines. Other public agencies could use accurate resident locations for school bus routing, zoning decision, or permit applications.

Interest in creating accurate addresses in the county was shared by James King, postmaster for the town of Berryville. He agreed to assist the county in verifying the location of rural delivery route boxes by ZIP+4 designations. Since the ZIP+4 system follows county road carrier routes, carriers could identify the approximate location on county maps of resident's mail boxes. County staff could verify these address files by direct observation and use portable geo-positioning devices for accurate coordinate positioning. Address ranges for rural route boxes were thus linked to the post office route box number. Priority areas were identified which were vulnerable to either natural or chemical hazards. Addressing for these priority areas were to be completed by the county staff.

The county manager and the postmaster both expressed a concern that many local residents wanted to avoid accurate addressing of residents. Avoiding the public eye and maintaining privacy in a rural culture was a major factor that had limited prior addressing efforts. The postmaster noted that many patrons were offended when clerks asked for identification when their personal checks did not have an address. Clerks, however, could often avoid this conflict by recognizing the patron from past contacts.

Both the county manager and postmaster commented that local residents might resist efforts by the county or the post office to identify their residence in a database. Experience from other local communities to name roads and have accurate locations of residents had met resistance from rural residents. Both the postmaster and county manager agreed that initiatives to name rural roads and use a numbering system to identify resident locations should be coordinated. Linking local addressing to enhancing the 911 system where residents would benefit from change could be critical in avoiding conflict with residents.

Expanding GIS Users

A critical factor in making the GIS more useful in emergency management was the expansion of the system to personal computers. By using ArcView2, the county could use all existing county coverages, including the new street and road census Tiger files. This GIS could be used on personal computers in the 911 dispatch office, volunteer fire stations, the Clarke County school board, town planning and zoning offices, and the county emergency management office. Using ArcView2 on either a desktop or portable computer would extend the county's GIS applications beyond the current two staff members. With a minimum of 16MB of RAM and 100 MB of hard disk space, ArcView2

provides other county and town agencies with current map files from the Clarke County GIS. ArcView2 provides an easy to use map display and query system. For emergency management, the personal computer GIS provides agencies with the ability to identify residents, to notify residents in a specific area of a risk, to make informed zoning or permitting decisions, or to route emergency service vehicles. Networking of the county offices will allow agencies taking advantage of the PC based GIS to use or copy current map files without taking the valuable time of the GIS county staff. Decision making can be enhanced by this easy-to-use GIS tool.

Future Initiatives

The county manager noted several initiatives that would enhance the use of GIS in emergency management decision making. Although flooding had not been an extensive problem in the past ten years, the snowfall and rain of January and February 1996 left the county uninformed on where flooding would occur. Shenandoah River levels were available from sites over 25 miles from the county. Information on local river and creek levels would have been very helpful in warning residents of flooding dangers or in suggesting evacuation routes. In addition, elevation points along the Shenandoah River and county creeks would allow county officials to more accurately predict areas vulnerable to flooding. Verification of FEMA flood maps would also ensure that permitting and zoning decisions would be accurate.

Accurate identification of residences and buildings was considered by the county as a high priority. The initial step in linking post office rural delivery routs to county road segments (thus creating address ranges similar to more populated area) was an important step. Naming rural roads and assigning addresses would be the next step and easier to accomplish with accurate location of rural delivery box identification.

Conclusions

County officials in this small rural jurisdiction overwhelmingly cited the value of GIS in supporting decision making at the local level. GIS with resident information, resource data, hazard information, and road data would be valuable in enhancing emergency planning, response, mitigation, and recovery efforts by the county or other state or local organizations. Changes to the Clarke County GIS were seen as natural steps to the evolution of their system. The additions to the county GIS were easy to accomplish with a greater knowledge of available data files and the cooperation of other government agencies such as the post office.

Local governments should view GIS as a useful tool that can be obtained on even a small budget. Early initiatives into GIS may have cost local governments large sums of money. Personal computers that can run 32 bit operating systems with large storage capacity make GIS affordable and easy to establish, even in a small community such as Clarke County. The uses of the Clarke County GIS will expand as more agencies become involved and as the cost of computers and programs continue to drop. Clarke County found that their GIS had benefits for emergency management and even more so for other applications within the jurisdiction.

APPENDIX A

1990 Census Population Data

Virginia

Clarke County

STF 3A Files

1992

1990 Census of Population and Housing**040 Virginia****050 Clarke County**

URBAN AND RURAL RESIDENCE

Total population.....	12,101
Urban population.....	3,097
Percent of total population.....	25.6
Rural population.....	9,004
Percent of total population.....	74.4
Farm population.....	769

SCHOOL ENROLLMENT

Persons 3 years and over enrolled in school.....	2,433
Preprimary school.....	181
Elementary or high school.....	1,859
Percent in private school.....	10.6
College.....	393

EDUCATIONAL ATTAINMENT

Persons 25 years and over.....	8,348
Less than 9th grade.....	987
9th to 12th grade, no diploma.....	1,100
High school graduate.....	2,853
Some college, no degree.....	1,532
Associates degree.....	326
Bachelor's degree.....	1,134
Graduate or professional degree.....	416
Percent high school graduate or higher.....	75.0
Percent bachelor's degree or higher.....	18.6

RESIDENCE IN 1985

Persons 5 years and over.....	11,338
Lived in same house.....	6,342
Lived in different house in U.S.....	4,966
Same State.....	4,190
Same county.....	1,372
Different county.....	2,818
Different State.....	776
Lived abroad.....	30

DISABILITY OF CIVILIAN NONINSTITUTIONALIZED PERSONS

Persons 16 to 64 years.....	7,785
With a mobility or self-care limitation.....	316
With a mobility limitation.....	144
With a self-care limitation.....	213
With a work disability.....	623
In labor force.....	294
Prevented from working.....	268
Persons 65 years and over.....	1,560
With a mobility or self-care limitation.....	268
With a mobility limitation.....	213
With a self-care limitation.....	147

CHILDREN EVER BORN PER 1,000 WOMEN

Women 15 to 24 years.....	366
Women 25 to 34 years.....	1,102
Women 35 to 44 years.....	1,646

VETERAN STATUS

Civilian veterans 16 years and over.....	1,388
65 years and over.....	349

NATIVITY AND PLACE OF BIRTH

Native population.....	11,913
Percent born in state of residence.....	65.1
Foreign-born population.....	188
Entered the U.S. 1980 to 1990.....	56

LANGUAGE SPOKEN AT HOME

Persons 5 years and over.....	11,338
Speak a language other than English.....	321
Do not speak English 'very well'.....	54
Speak Spanish.....	91
Do not speak English 'very well'.....	15
Speak Asian or Pacific Island language.....	72
Do not speak English 'very well'.....	21

ANCESTRY

Total ancestries reported.....	7,695
Arab.....	0
Austrian.....	31
Belgian.....	0
Canadian.....	37
Czech.....	99
Danish.....	7
Dutch.....	219
English.....	1,454
Finnish.....	0
French (except Basque).....	242
French Canadian.....	57
German.....	1,859
Greek.....	10
Hungarian.....	18
Irish.....	1,081
Italian.....	144
Lithuanian.....	31
Norwegian.....	41
Polish.....	58
Portuguese.....	4
Romanian.....	5
Russian.....	39
Scotch-Irish.....	305
Scottish.....	229
Slovak.....	12
Subsaharan African.....	0
Swedish.....	9
Swiss.....	7
Ukrainian.....	14
United States or American.....	701
Welsh.....	101
West Indian (excluding Hispanic origin groups).....	8
Yugoslavian.....	0
Other ancestries.....	87

1990 Census of Population and Housing

040 Virginia

050 Clarke County

Total housing units.....4,531

YEAR STRUCTURE BUILT

1989 to March 1990.....	134
1985 to 1988.....	388
1980 to 1984.....	446
1970 to 1979.....	1,091
1960 to 1969.....	522
1950 to 1959.....	459
1940 to 1949.....	124
1939 or earlier.....	1,367

BEDROOMS

No bedroom.....	35
1 bedroom.....	137
2 bedrooms.....	1,070
3 bedrooms.....	2,334
4 bedrooms.....	688
5 or more bedrooms.....	267

SELECTED CHARACTERISTICS

Lacking complete plumbing facilities.....	147
Lacking complete kitchen facilities.....	105
Condominium housing units.....	22

SOURCE OF WATER

Public system or private company.....	1,705
Individual drilled well.....	2,521
Individual dug well.....	142
Some other source.....	163

SEWAGE DISPOSAL

Public sewer.....	1,228
Septic tank or cesspool.....	3,115
Other means.....	188

Occupied housing units.....4,236

HOUSE HEATING FUEL	
Utility gas.....	26
Bottled, tank, or LP gas.....	202
Electricity.....	1,738
Fuel oil, kerosene, etc.....	1,507
Coal or coke.....	16
Wood.....	733
Solar energy.....	8
Other fuel.....	0
No fuel used.....	6
YEAR HOUSEHOLDER MOVED INTO UNIT	
1989 to March 1990.....	586
1985 to 1988.....	1,209
1980 to 1984.....	637
1970 to 1979.....	923
1960 to 1969.....	396
1959 or earlier.....	485
TELEPHONE	
No telephone in unit.....	115
VEHICLES AVAILABLE	
Occupied housing units.....	4,236
None.....	327
1.....	972
2.....	1,786
3 or more.....	1,151
MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS	
Specified owner-occupied housing units.....	2,288
With a mortgage.....	1,371
Less than \$300.....	88
\$300 to \$499.....	173
\$500 to \$699.....	265
\$700 to \$999.....	474
\$1,000 to \$1,499.....	278
\$1,500 to \$1,999.....	83
\$2,000 or more.....	10
Median (dollars).....	779
Not mortgaged.....	917
Less than \$100.....	59
\$100 to \$199.....	417
\$200 to \$299.....	346
\$300 to \$399.....	62
\$400 or more.....	33
Median (dollars).....	196
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1989	
Specified owner-occupied housing units.....	2,288
Less than 20 percent.....	1,316
20 to 24 percent.....	206
25 to 29 percent.....	224
30 to 34 percent.....	120
35 percent or more.....	390
Not computed.....	32
GROSS RENT	
Specified renter-occupied housing units.....	848
Less than \$200.....	64
\$200 to \$299.....	59
\$300 to \$499.....	292

1990 Census of Population and Housing

040 Virginia

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INCOME IN 1989	
Households.....	4,185
Less than \$5,000.....	224
\$5,000 to \$9,999.....	221
\$10,000 to \$14,999.....	337
\$15,000 to \$24,999.....	584
\$25,000 to \$34,999.....	745
\$35,000 to \$49,999.....	917
\$50,000 to \$74,999.....	611

\$75,000 to \$99,999.....	294
\$100,000 to \$149,999.....	173
\$150,000 or more.....	79
Median household income (dollars).....	34,636

Families.....	3,243
Less than \$5,000.....	80
\$5,000 to \$9,999.....	131
\$10,000 to \$14,999.....	217
\$15,000 to \$24,999.....	428
\$25,000 to \$34,999.....	603
\$35,000 to \$49,999.....	756
\$50,000 to \$74,999.....	551
\$75,000 to \$99,999.....	272
\$100,000 to \$149,999.....	129
\$150,000 or more.....	76
Median family income (dollars).....	38,096

Nonfamily households.....	942
Less than \$5,000.....	151
\$5,000 to \$9,999.....	93
\$10,000 to \$14,999.....	136
\$15,000 to \$24,999.....	187
\$25,000 to \$34,999.....	155
\$35,000 to \$49,999.....	127
\$50,000 to \$74,999.....	78
\$75,000 to \$99,999.....	0
\$100,000 to \$149,999.....	12
\$150,000 or more.....	3
Median nonfamily household income (dollars).....	20,216

Per capita income (dollars).....15,657

INCOME TYPE IN 1989

Households.....	4,185
With wage and salary income.....	3,282
Mean wage and salary income (dollars).....	39,160
With nonfarm self-employment income.....	710
Mean nonfarm self-employment income (dollars).....	21,965
With farm self-employment income.....	228
Mean farm self-employment income (dollars).....	13,558
With Social Security income.....	1,292
Mean Social Security income (dollars).....	6,529
With public assistance income.....	217
Mean public assistance income (dollars).....	3,604
With retirement income.....	752
Mean retirement income (dollars).....	10,544

POVERTY STATUS IN 1989

All persons for whom poverty status is determined.....	11,711
Below poverty level.....	1,021
Persons 18 years and over.....	9,048
Below poverty level.....	740
Persons 65 years and over.....	1,560
Below poverty level.....	247
Related children under 18 years.....	2,648
Below poverty level.....	266
Related children under 5 years.....	753
Below poverty level.....	65
Related children 5 to 17 years.....	1,895
Below poverty level.....	201
Unrelated individuals.....	1,452
Below poverty level.....	303
All families.....	3,243
Below poverty level.....	213
With related children under 18 years.....	1,499
Below poverty level.....	118
With related children under 5 years.....	631
Below poverty level.....	44
Female householder families.....	517
Below poverty level.....	44
With related children under 18 years.....	225
Below poverty level.....	23
With related children under 5 years.....	30

Below poverty level.....	8
Percent below poverty level:	

All persons.....	8.7
Persons 18 years and over.....	8.2
Persons 65 years and over.....	15.8
Related children under 18 years.....	10.0
Related children under 5 years.....	8.6
Related children 5 to 17 years.....	10.6
Unrelated individuals.....	20.9
All families.....	6.6
With related children under 18 years.....	7.9
With related children under 5 years.....	7.0
Female householder families.....	8.5
With related children under 18 years.....	10.2
With related children under 5 years.....	26.7

1990 Census of Population and Housing

040 Virginia

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LABOR FORCE STATUS

Persons 16 years and over.....	9,648
In labor force.....	6,352
Percent in labor force.....	65.8
Civilian labor force.....	6,344
Employed.....	6,190
Unemployed.....	154
Percent unemployed.....	2.4
Armed Forces.....	8
Not in labor force.....	3,296
Males 16 years and over.....	4,719
In labor force.....	3,505
Percent in labor force.....	74.3
Civilian labor force.....	3,501
Employed.....	3,431
Unemployed.....	70
Percent unemployed.....	2.0
Armed Forces.....	4
Not in labor force.....	1,214
Females 16 years and over.....	4,929
In labor force.....	2,847
Percent in labor force.....	57.8
Civilian labor force.....	2,843
Employed.....	2,759
Unemployed.....	84
Percent unemployed.....	3.0
Armed Forces.....	4
Not in labor force.....	2,082
Females 16 years and over.....	4,929
With own children under 6 years.....	627
Percent in labor force.....	62.2
With own children 6 to 17 years only.....	719
Percent in labor force.....	81.8
Own children under 6 years in families and subfamilies...	860
All parents present in household in labor force.....	538
Own children 6 to 17 years in families and subfamilies.....	1,637
All parents present in household in labor force.....	1,222
Persons 16 to 19 years.....	608
Not enrolled in school and not high school graduate.....	114
Employed or in Armed Forces.....	63
Unemployed.....	2
Not in labor force.....	49
COMMUTING TO WORK	
Workers 16 years and over.....	6,084
Percent drove alone.....	70.8
Percent in carpools.....	17.9

Percent using public transportation.....	0.4
Percent using other means.....	0.4
Percent walked or worked at home.....	10.5
Mean travel time to work (minutes).....	29.3

OCCUPATION

Employed persons 16 years and over.....	6,190
Executive, administrative, and managerial occupations.....	543
Professional specialty occupations.....	673
Technicians and related support occupations.....	195
Sales occupations.....	671
Administrative support occupations, including clerical.....	857
Private household occupations.....	65
Protective service occupations.....	79
Service occupations, except protective and household.....	692
Farming, forestry, and fishing occupations.....	403
Precision production, craft, and repair occupations.....	1,030
Machine operators, assemblers, and inspectors.....	381
Transportation and material moving occupations.....	246
Handlers, equipment cleaners, helpers, and laborers.....	355

INDUSTRY

Employed person 16 years and over.....	6,190
Agriculture, forestry, and fisheries.....	511
Mining.....	11
Construction.....	854
Manufacturing, nondurable goods.....	506
Manufacturing, durable goods.....	443
Transportation.....	211
Communications and other public utilities.....	140
Wholesale trade.....	147
Retail trade.....	995
Finance, insurance, and real estate.....	368
Business and repair services.....	270
Personal services.....	207
Entertainment, and recreation services.....	76
Health services.....	296
Educational services.....	429
Other professional and related services.....	420
Public administration.....	306

CLASS OF WORKER

Employed persons 16 years and over.....	6,190
Private wage and salary workers.....	4,700
Government workers.....	824
Local government workers.....	408
State government workers.....	139
Federal government workers.....	277
Self-employed workers.....	600
Unpaid family workers.....	6

1990 Census Of Population And Housing Summary Tape File 3A**040 Virginia****050 Clarke County**

INDUSTRY

Universe: Employed persons 16 years and over

Agriculture, forestry, and fisheries (000-039).....	511
Mining (040-059).....	11
Construction (060-099).....	854
Manufacturing, nondurable goods (100-229).....	506
Manufacturing, durable goods (230-399).....	443
Transportation (400-439).....	211
Communications and other public utilities (440-499).....	140
Wholesale trade (500-579).....	147
Retail trade (580-699).....	995
Finance, insurance, and real estate (700-720).....	368
Business and repair services (721-760).....	270
Personal services (761-799).....	207
Entertainment and recreation services (800-811).....	76
Professional and related services (812-899):	
Health services (812-840).....	296
Educational services (842-860).....	429
Other professional and related services (841, 861-899).....	420
Public administration (900-939).....	306

1990 Census Of Population And Housing Summary Tape File 3A

040 Virginia

050 Clarke County

OCCUPATION

Universe: Employed persons 16 years and over

Managerial and professional specialty occupations (000-202):	
Executive, administrative, and managerial occupations (000-042)...	543
Professional specialty occupations (043-202).....	673
Technical, sales, and administrative support occupations (203-402):	
Technicians and related support occupations (203-242).....	195
Sales occupations (243-302).....	671
Administrative support occupations, including clerical (303-402)..	857
Service occupations (403-472):	
Private household occupations (403-412).....	65
Protective service occupations (413-432).....	79
Service occupations, except protective and household (433-472)....	692
Farming, forestry, and fishing occupations (473-502).....	403
Precision production, craft, and repair occupations (503-702).....	1,030
Operators, fabricators, and laborers (703-902):	
Machine operators, assemblers, and inspectors (703-802).....	381
Transportation and material moving occupations (803-863).....	246
Handlers, equipment cleaners, helpers, and laborers (864-902).....	355

1990 Census of Population and Housing

040 Virginia

160 Berryville town

URBAN AND RURAL RESIDENCE

Total population.....	3,097
Urban population.....	3,097
Percent of total population.....	100.0
Rural population.....	0
Percent of total population.....	0.0
Farm population.....	0

SCHOOL ENROLLMENT

Persons 3 years and over enrolled in school.....	541
Preprimary school.....	32
Elementary or high school.....	450
Percent in private school.....	4.0
College.....	59

EDUCATIONAL ATTAINMENT

Persons 25 years and over.....	2,184
Less than 9th grade.....	303
9th to 12th grade, no diploma.....	343
High school graduate.....	773
Some college, no degree.....	356
Associates degree.....	70
Bachelor's degree.....	224
Graduate or professional degree.....	115
Percent high school graduate or higher.....	70.4
Percent bachelor's degree or higher.....	15.5

RESIDENCE IN 1985

Persons 5 years and over.....	2,908
Lived in same house.....	1,698
Lived in different house in U.S.....	1,208
Same State.....	1,019
Same county.....	468
Different county.....	551
Different State.....	189
Lived abroad.....	2

DISABILITY OF CIVILIAN NONINSTITUTIONALIZED PERSONS

Persons 16 to 64 years.....	1,863
With a mobility or self-care limitation.....	75
With a mobility limitation.....	49
With a self-care limitation.....	41
With a work disability.....	123
In labor force.....	50
Prevented from working.....	60
Persons 65 years and over.....	507
With a mobility or self-care limitation.....	69

With a mobility limitation.....	68
With a self-care limitation.....	34
CHILDREN EVER BORN PER 1,000 WOMEN	
Women 15 to 24 years.....	385
Women 25 to 34 years.....	954
Women 35 to 44 years.....	1,793
VETERAN STATUS	
Civilian veterans 16 years and over.....	327
65 years and over.....	90
NATIVITY AND PLACE OF BIRTH	
Native population.....	3,074
Percent born in state of residence.....	70.4
Foreign-born population.....	23
Entered the U.S. 1980 to 1990.....	6
LANGUAGE SPOKEN AT HOME	
Persons 5 years and over.....	2,908
Speak a language other than English.....	63
Do not speak English 'very well'.....	22
Speak Spanish.....	24
Do not speak English 'very well'.....	15
Speak Asian or Pacific Island language.....	3
Do not speak English 'very well'.....	0
ANCESTRY	
Total ancestries reported.....	1,789
Arab.....	0
Austrian.....	0
Belgian.....	0
Canadian.....	0
Czech.....	18
Danish.....	7
Dutch.....	49
English.....	337
Finnish.....	0
French (except Basque).....	63
French Canadian.....	19
German.....	373
Greek.....	3
Hungarian.....	2
Irish.....	244
Italian.....	31
Lithuanian.....	4
Norwegian.....	0
Polish.....	3
Portuguese.....	0
Romanian.....	0
Russian.....	0
Scotch-Irish.....	94
Scottish.....	46
Slovak.....	4
Subsaharan African.....	0
Swedish.....	2
Swiss.....	2
Ukrainian.....	0
United States or American.....	185
Welsh.....	30
West Indian (excluding Hispanic origin groups).....	2
Yugoslavian.....	0
Other ancestries.....	271

1990 Census of Population and Housing

040 Virginia

160 Boyce town

URBAN AND RURAL RESIDENCE	
Total population.....	512
Urban population.....	0
Percent of total population.....	0.0
Rural population.....	512
Percent of total population.....	100.0
Farm population.....	7
SCHOOL ENROLLMENT	
Persons 3 years and over enrolled in school.....	121

Preprimary school.....	12
Elementary or high school.....	87
Percent in private school.....	4.6
College.....	22
EDUCATIONAL ATTAINMENT	
Persons 25 years and over.....	338
Less than 9th grade.....	47
9th to 12th grade, no diploma.....	58
High school graduate.....	97
Some college, no degree.....	88
Associates degree.....	7
Bachelor's degree.....	32
Graduate or professional degree.....	9
Percent high school graduate or higher.....	68.9
Percent bachelor's degree or higher.....	12.1
RESIDENCE IN 1985	
Persons 5 years and over.....	479
Lived in same house.....	300
Lived in different house in U.S.....	179
Same State.....	164
Same county.....	68
Different county.....	96
Different State.....	15
Lived abroad.....	0
DISABILITY OF CIVILIAN NONINSTITUTIONALIZED PERSONS	
Persons 16 to 64 years.....	314
With a mobility or self-care limitation.....	0
With a mobility limitation.....	0
With a self-care limitation.....	0
With a work disability.....	23
In labor force.....	12
Prevented from working.....	8
Persons 65 years and over.....	75
With a mobility or self-care limitation.....	16
With a mobility limitation.....	2
With a self-care limitation.....	14
CHILDREN EVER BORN PER 1,000 WOMEN	
Women 15 to 24 years.....	294
Women 25 to 34 years.....	1,500
Women 35 to 44 years.....	1,463
VETERAN STATUS	
Civilian veterans 16 years and over.....	62
65 years and over.....	17
NATIVITY AND PLACE OF BIRTH	
Native population.....	507
Percent born in state of residence.....	82.2
Foreign-born population.....	5
Entered the U.S. 1980 to 1990.....	0
LANGUAGE SPOKEN AT HOME	
Persons 5 years and over.....	479
Speak a language other than English.....	16
Do not speak English 'very well'.....	1
Speak Spanish.....	12
Do not speak English 'very well'.....	0
Speak Asian or Pacific Island language.....	1
Do not speak English 'very well'.....	1
ANCESTRY	
Total ancestries reported.....	265
Arab.....	0
Austrian.....	0
Belgian.....	0
Canadian.....	0
Czech.....	0
Danish.....	0
Dutch.....	18
English.....	35
Finnish.....	0
French (except Basque).....	0
French Canadian.....	9
German.....	73
Greek.....	0
Hungarian.....	2
Irish.....	35

Italian.....	0
Lithuanian.....	8
Norwegian.....	0
Polish.....	8
Portuguese.....	0
Romanian.....	0
Russian.....	0
Scotch-Irish.....	1
Scottish.....	3
Slovak.....	0
Subsaharan African.....	0
Swedish.....	0
Swiss.....	0
Ukrainian.....	1
United States or American.....	25
Welsh.....	0
West Indian (excluding Hispanic origin groups).....	0
Yugoslavian.....	0
Other ancestries.....	47
\$500 to \$749.....	221
\$750 to \$999.....	25
\$1,000 or more.....	0
No cash rent.....	187
Median (dollars).....	441

GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1989

Specified renter-occupied housing units.....	848
Less than 20 percent.....	298
20 to 24 percent.....	122
25 to 29 percent.....	97
30 to 34 percent.....	37
35 percent or more.....	105
Not computed.....	189

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